by a detailed water sampling programme to locate the uraniferous structures prior to ground geophysical methods and prospecting with ground scintillometers.

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Geophysical and geological field work on fault structures at the Igaliko peninsula, South Greenland

Per Nyegaard and Leif Thorning

Uranium exploration carried out in South Greenland by the Syduran project in the last few years (Armour-Brown *et al.*, 1981) has indicated that certain major E–W fault structures are features worthy of attention in this connection. During August 1982 geological and geophysical field work was carried out 10 km south-south-east of Igaliko (fig. 25) around a fault zone which had earlier given indications of the presence of uranium mineral occurrences.

The object of the geological work was to map the surface within the geophysical grid and to make a gamma-radiation survey of the area. Pitchblende veins, found in connection with geochemical prospecting, were traced by trenching and were sampled.

The object of the geophysical work was firstly to evaluate the usefulness of various electromagnetic methods for locating and mapping the structures in the Julianehåb granite which contain uranium minerals and secondly to evaluate the extent of the known uranium mineral occurrences. Logistic support was supplied by the Syduran project base camp at Dyrnes.

Geology

The area investigated is underlain by the Ketilidian Julianehåb granite (1810–1770 m.y.; Van Breemen *et al.,* 1974). During the Gardar period (1330–1150 m.y.; Emeleus & Upton,

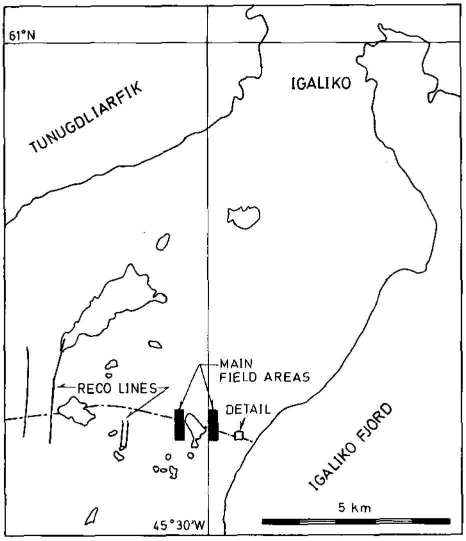

Fig. 25. Index map showing position of field area. The E–W fault zone is indicated.

1976) the granite was faulted and intruded by numerous ENE trending felsic dykes. Dolerite dykes were intruded in E–W fault zones but have also an ENE-trend.

The area is cut by a major E–W fault zone, where at least four fault planes are observed. The direction of movement is indicated by a 'big-feldspar' dyke, which displays a minimum sinistral displacement of 150–200 m, and the lateral movement is indicated by horizontal slickensides on the fault planes. The zone is intruded by 5–10 m wide felsic dykes and by a dolerite dyke, 25–50 m wide.

The main direction of the minor faults and joints in the area is 90–100° and 60–70°, however, the 90° direction is nearly absent outside the fault zone.

The granite in the fault zone shows strong alteration with reddening of the feldspar. There is a gradual change from fresh to altered granite starting along joints and minor faults. Brecciation with quartz veins up to 25 m wide is seen especially in the more brittle felsic dykes. In the border of the veins many angular fragments of the wall rock are seen, while the centre of the veins is more massive quartz. The quartz is associated with carbonate and some fluorite. Quartz fillings of tension gashes are also observed in this structure. Small (1–5 cm) quartz veins are common as fracture fillings in all rock types in the fault zone. The quartz is often associated with carbonate and fluorite but is barren of base metals. Specularite with normal hematite is a common fracture filling. Only at one locality a small (0.5 × 3 m) non-radioactive quartz vein with a cuprite-galena mineral occurrence was found.

Three pitchblende veins are located in the fault zone. The pitchblende is associated with fluorite, some quartz, minor pyrite and chalcopyrite and secondary yellow uranium minerals and malachite. The width of the veins is 1–3 cm and they were followed 12–15 m by trenching and surface radiation measurements. The strike of vein 1 is E–W. Vein 2 proved by trenching to be two 'en echelon' veins also trending E–W. Vein 3 has a strike of approximately 40° and the three veins have dips close to vertical.

The pitchblende veins have been sampled by trenching and blasting, and samples (*c.* 3 kg)

Table 3. Gamma-spectrometric measurements over pitchblende-bearing veins

Vein 1 - Trench 1								
	0.95							%eU
	2402							ppm eTh
Vein 2 - Trench 2		3	4	5	8	9	mean	
	9.08	1.37	4.42	6.22	3.94	6.31	5.22	%eU
	3580	39	431	1760	781	1550		ppm eTh
Vein 3 - Trench 2		3	4	5	6		mean	
	1.74	0.80	0.76	2.69	0.96		1.39	%eU
	72	97	0	0	0			ppm eTh

covering ½ × ½ m were collected in the trenches. The samples were assayed in the base camp by gamma-spectrometry. The results are given in Table 3.

The radioactivity in the areas around the three veins and in the grid laid out for the geophysical survey was systemetically measured with a Saphymo SPP2 scintillometer.

A geological map covering the grid was produced on the scale 1:2500. As the outcrop covered only 1 to 2 per cent of the area, the map mainly shows the nature of the overburden, which it was thought may influence the geophysical measurements.

Soil samples were collected systematically around one of the pitchblende veins and were assayed in the base camp for extractable uranium. The results of this work showed that this method of detailed geochemical prospecting does not work in this area, as there was very little relation between the buried veins and the uranium values in the soils. This is due partly to glacial and sheet wash transported overburden and the uncertainty of the geochemical transport in the ground water.

Geophysics

The methods and instruments applied are briefly described by L. Thorning elsewhere in this report. The geophysical work was carried out by the same team.

Approximately 12 km of magnetic and Very Low Frequency Electromagnetic (VLF EM) data were acquired in a regular grid along N–S lines around the lake at 205 m (fig. 25). The French station FUO (15.1 kHz) was used as the very low frequency source, and the geometry of geological strike and the direction to the VLF station was ideal. Multifrequency horizontal loop EM measurements were obtained along some of the profiles (*c.* 3 km, Tx-Rx distance 100 m), but no significant variations were measured presumably because massive sulphides, to which this method is particularly applicable, were not present. Magnetic susceptibility was measured at sites both within and outside the fault zone.

Approximately 4 km of reconnaissance lines with magnetic and VLF EM data were aquired to the west, and crossing the continuation of the fault zone.

The magnetic and VLF EM data gave excellent results. The data were compiled in the field, and a number of conductors, thought to be connected with various fault structures, were mapped. Subsequent detailed geological investigation has supported this interpretation. The result of the geophysical field work will be published later, but one example of a

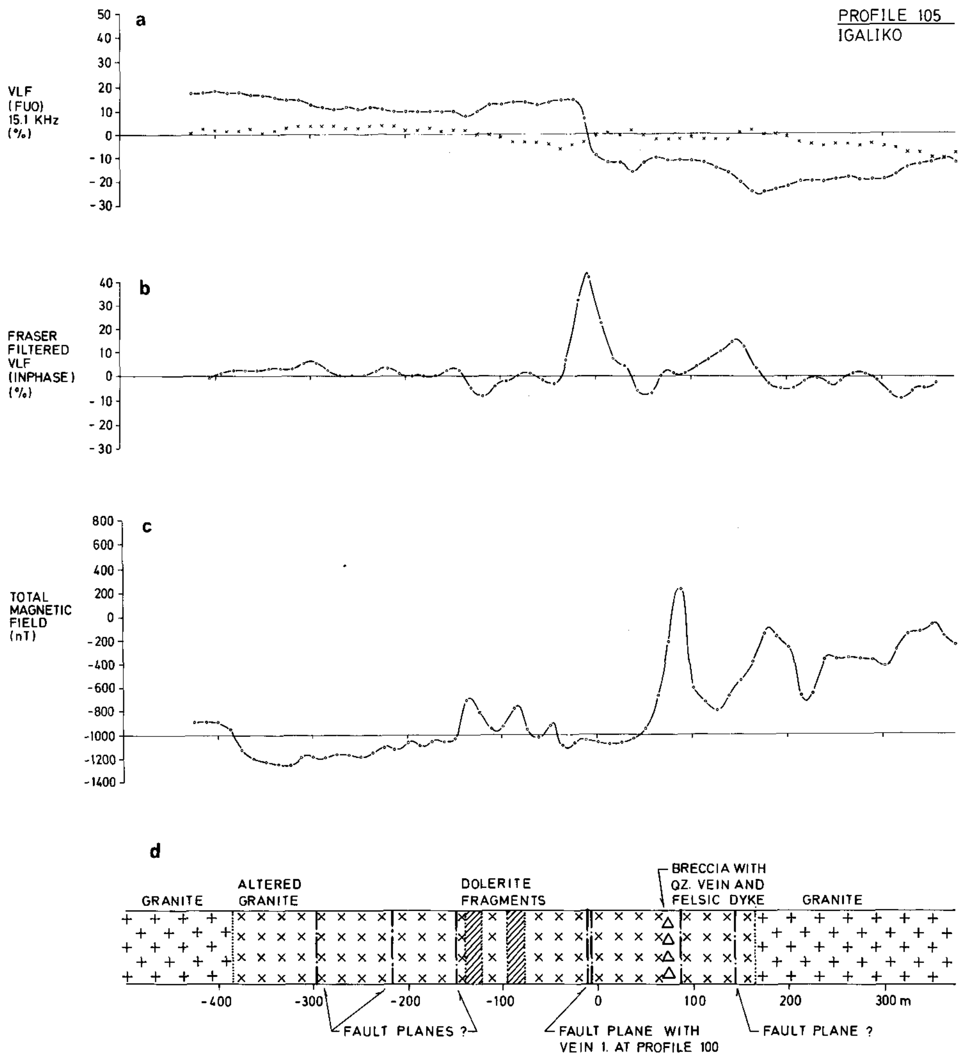

Fig. 26. Profile east of lake 205 showing, (a) VLF EM inphase (points joined) and quadrature (crosses), (b) Fraser (1969) filtered inphase VLF EM field, (c) total magnetic field, and (d) interpretation of the geology along the profile. Position of VLF conductors revealed by position of tops on the Fraser filtered profile.

profile has been included in this report (profile 105, fig. 26). The profile illustrates how the fault zone in general is revealed by a broad magnetic low and a number of small VLF conductors which can be correlated with dykes or individual fault planes.

Detailed (2 × 3 m) VLF EM and magnetic data were obtained over a uranium mineral occurrence in the fault zone which was confirmed by trenching. These data will be used in an attempt to find if the uranium mineralisation can be mapped by geophysical methods.

Conclusions

The main E–W fault zone crossing the investigated area shows a sinistral displacement at a minimum of 150–200 m. Within the zone, pitchblende veins have been found. Two of the veins follow closely the direction of the major fault zone, but the third has a trend which could be a tension fracture filling. Also the minor radioactive spots located in the area are found within the fault zone. Vein samples assayed by gamma spectrometry contain from 0.75 to 6.3% U and very little thorium. The high values from vein 2 may be due to oversampling of pitchblende chips.

The geophysical investigations described here have shown that magnetic and VLF profiling, supported by susceptibility and VLF resistivity measurements, are excellent methods for mapping various structures connected with a fault zone. The width of the fault zone is well defined by both magnetic and VLF EM methods, and features revealed as VLF conductors were observable over several profiles.

The distinct magnetic low over the strongly altered fault zone is probably due to the decomposition of magnetite. The magnetic highs can be correlated with some of the dykes, and the VLF conductors can be correlated with fault planes and the breccia-like quartz veins. The pitchblende vein inside the grid lies close to a very strong VLF anomaly, possibly a fault plane, but no other outcrops are seen along the trend of the anomaly.

It is obvious that regional geophysical mapping of such structures will be possible. Ideally, this should be done as an airborne survey, but further production-type ground-based geophysical surveys would also be useful in defining potential structures carrying an occurrence of uranium minerals.

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Archaean gneisses and supracrustal rocks of the Tingmiarmiut region, South-East Greenland

Jan C. Escher and Troels F. D. Nielsen

In August 1981 a mapping programme was initiated which aimed at the production of the 1:500 000 geological map sheet of the Tingmiarmiut–Angmagssalik region (sheet No. 14) (Escher & Nielsen, 1982). In 1982 this programme was continued in the Tingmiarmiut Fjord